

Water Quality and Biological Assessment of the Lower Reservoirs of the Susquehanna River

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Susquehanna River Basin

The Basin

- 27,510-square-mile watershed
- Comprises 43% of the Chesapeake Bay watershed
- 60% forested
- 32,000+ miles of waterways

The Susquehanna River

- 444 miles, largest tributary to the Chesapeake Bay
- Supplies 18 million gallons a minute to the bay

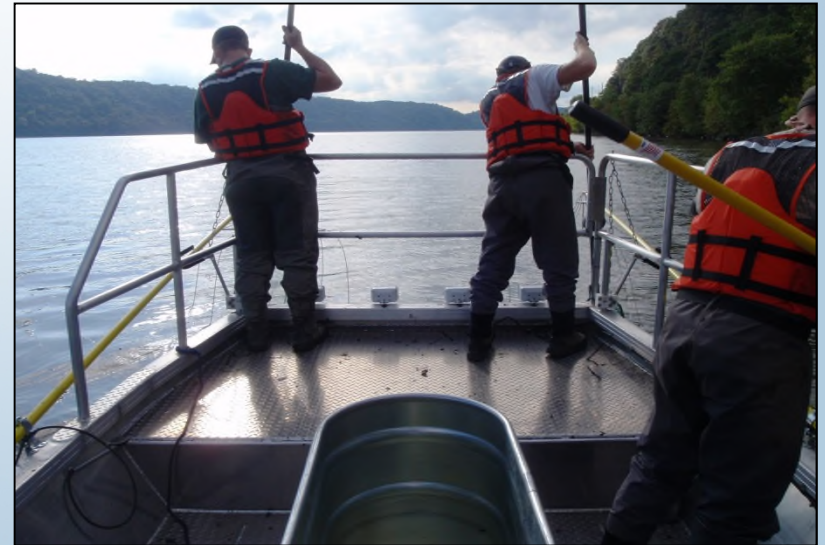
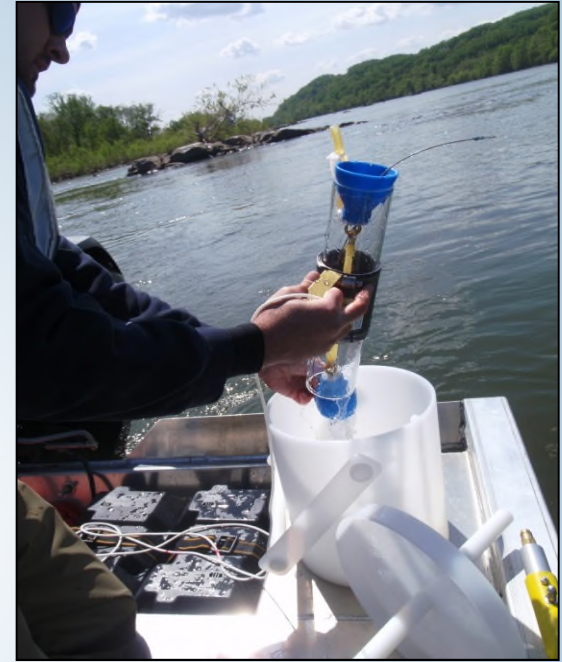
SRBC

- Interstate Compact Commission
- Regulates withdrawals for surface, ground, and consumptive water
- Water quality/biological – non regulatory



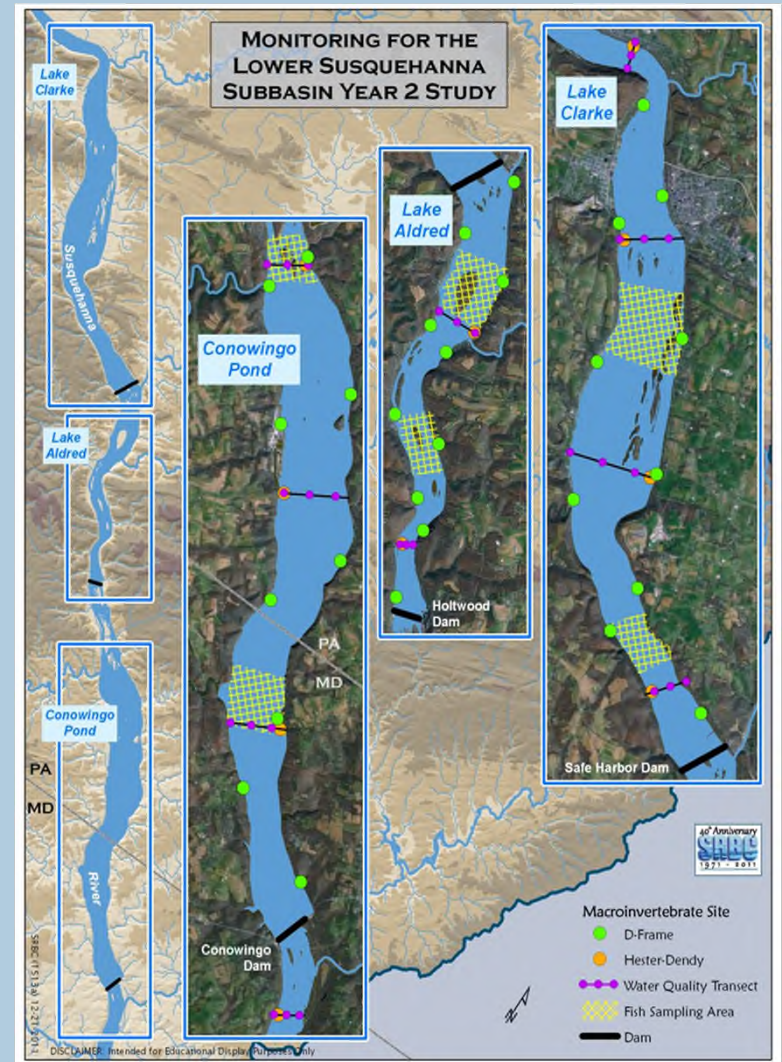
Objectives

- Examine water quality across transects
- Document extent of vertical mixing
- Assess macroinvertebrate assemblages
- Evaluate fish communities
- Compare sampling methodologies
- Use data and results to guide future efforts



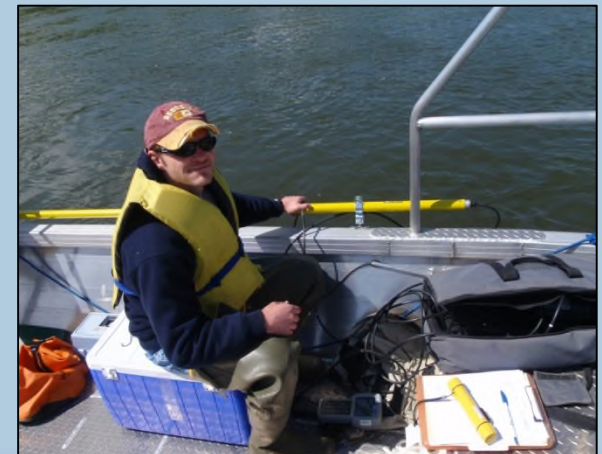
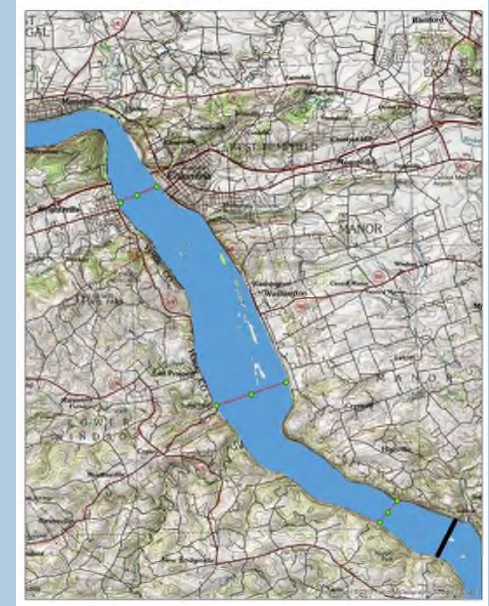
Methods

- Pilot study
- April – October 2012
- Seasonal water chemistry sampling
- Seasonal chlorophyll-a sampling
- Macroinvertebrate sampling
 - Hester-Dendy artificial substrate
 - Multi-habitat composite kick (D-frame)
- Fish sampling
 - Benthic trawling
 - Boat electrofishing



Water Quality

- 9 transects, 3 individual samples per transect
 - Widths ranged from 0.5 to 1.7 miles wide in this stretch of river
- Nearly complete vertical mixing
 - Almost all transects in all seasons: $< 1^{\circ}\text{C}$ and $< 1\text{ mg/l}$ dissolved oxygen, at depths up to 8.5 m
 - Only one transect showed any stratification
 - Conowingo Pond -summer
 - 1.3°C but 5.5 mg/l in dissolved oxygen from surface to 7.5 m



- Hybrid between free -flowing and reservoir
- Nutrients
 - Total nitrogen exceeded 1.0 mg/l in 50% of samples
 - Nitrogen was primarily nitrate: 99% of samples exceed 0.6 mg/l
 - Nitrite not above detection limits (0.07 mg/l), little ammonia or TKN
 - Total phosphorus exceeded 0.1 mg/l in less than 10 percent of the samples
 - Good for rivers, considered eutrophic for lakes
 - Chlorophyll-a, highest concentrations in spring, 15% of samples eutrophic
- Metals and other major ions
 - Metals highest in spring, Br, Cl, SO₄ highest in summer

Laboratory Parameters		Field Parameters
Total Suspended Solids	Total Nitrogen	Temperature
Total Dissolved Solids	Nitrate	Dissolved Oxygen
Aluminum	Nitrite	Conductivity
Alkalinity	Ammonia	pH
Sulfate	Total Kjeldahl Nitrogen	Turbidity
Chloride	Total Phosphorus	
Iron	Orthophosphate	
Bromide	Total Organic Carbon	
Biological Oxygen Demand	Dissolved Organic Carbon	
Chlorophyll a		

Macroinvertebrates

- Multi-habitat composite samples
 - more taxa,
 - more EPT taxa,
 - better Hilsenhoff Biotic Index (HBI) scores,
 - and a lower percentage of Chironomidae than the H-D samples
- Greater than 75 taxa were found
 - multi-habitat samples were comprised of 26-36 taxa
 - H-D samples had far fewer, ranging from 3-22 taxa
- Multi-habitat samples were dominated by the mayfly genera *Brachycercus* (Family Caenidae),
 - well suited to slow-moving rivers where fine sediment is the dominant substrate.
- H-D artificial substrate samples, dominated by Chironomidae genera made up from 59-99 percent of the sample,
 - 25 different genera identified



Summary Data

Summary of Macroinvertebrate Data for each Reservoir

MULTI-HABITAT (500 count subsample)

	Lake Clarke	Lake Aldred	Conowingo Pond
Taxa Richness	36	32	26
EPT Taxa	4	7	4
Hilsenhoff Biotic Index	5.63	4.54	3.51
Chironomidae taxa	12	6	9
% Chironomidae	17.1	5.6	10.4
% Dominant Taxa	42.1	40.8	40.6

HESTER-DENDY SAMPLERS (200 count subsample)

	Lake Clarke		Lake Aldred		Conowingo Pond		
	top	bottom	top	bottom	top	mid	bottom
Taxa Richness	22	11	11	5	18	5	15
EPT Taxa	4	0	2	0	4	0	6
Hilsenhoff Biotic Index	5.94	7.54	7.69	7.99	6.42	7.79	6.34
Chironomidae taxa	11	9	5	3	10	3	5
% Chironomidae	59.1	99.1	87.8	99.0	58.4	97.3	62.2
% Dominant Taxa	17.5	80.1	83.8	98.1	37.8	96.4	57.6

Lower Susquehanna River Fisheries

- Declining smallmouth bass population
 - DELTs, intersex, melanosis
- Diadromous fish restoration
 - American eel
 - American shad, river herring
- Invasive species
 - Flathead catfish
 - Mimic shiner
 - Banded & Greenside darters

Survey Area	Smallmouth Bass CPUE (fish/hr)	Smallmouth Bass DELT prevalence	Flathead Catfish: Channel Catfish Ratio	Richness
Lake Clarke	11.20	23%	1:5	21
Lake Aldred	10.96	9%	1:16	19
Conowingo Pond	9.31	8%	10:1	16
Below Conowingo Dam	2.98	0%	1:16	25
Total	9.2	13%	1:13	29

Smallmouth Bass Issues



Chesapeake Logperch

Percina bimaculata

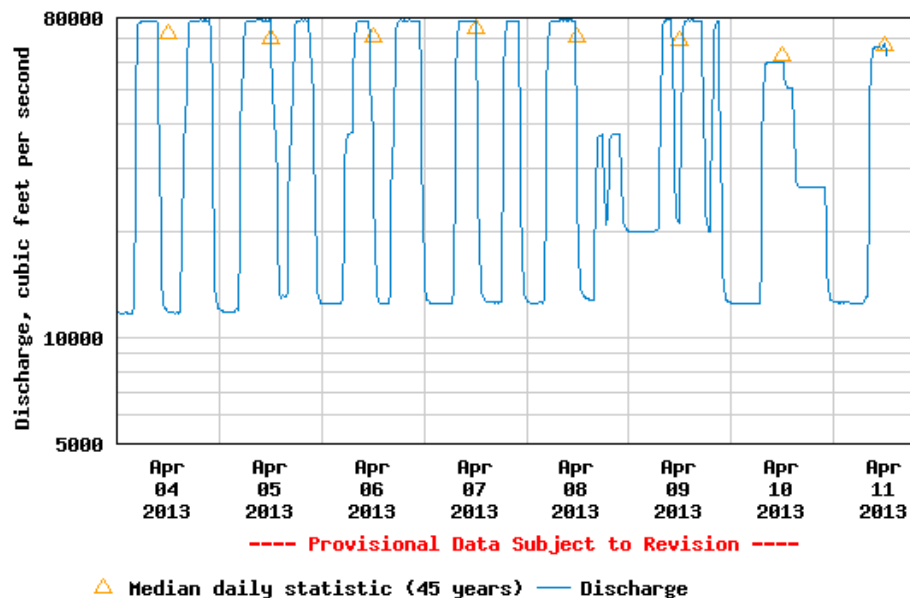
- Taxonomically distinct from *P. caprodes*
- Limited and declining distribution
 - Conowingo Pond and select direct tributaries
- PA status: threatened



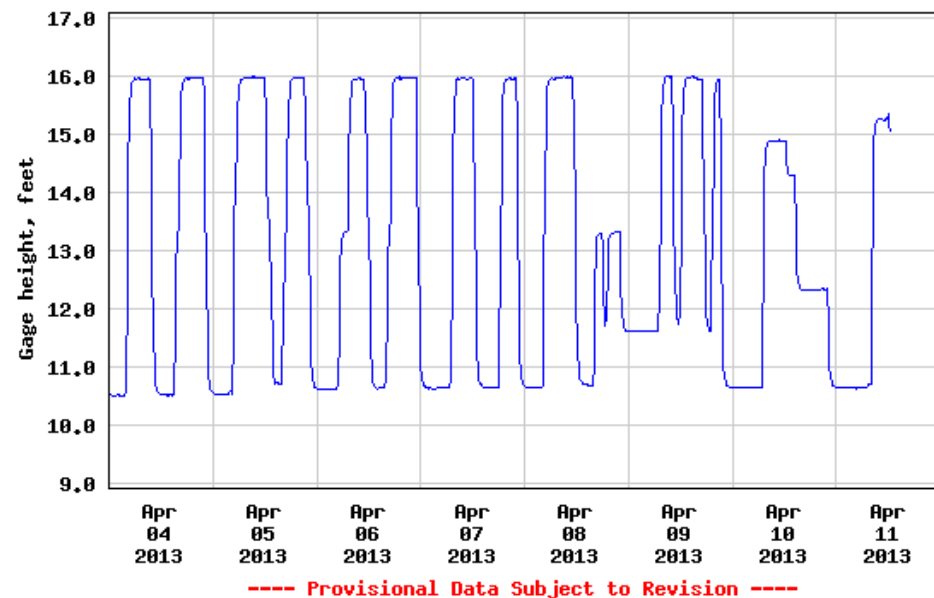
Fluctuating River Stages

Date	Time	Discharge (cfs)
9/24/12	11:00	4,080
9/24/12	12:15	83,100
9/24/12	18:45	24,600
9/24/12	23:45	6,510

USGS 01578310 SUSQUEHANNA RIVER AT CONOWINGO, MD

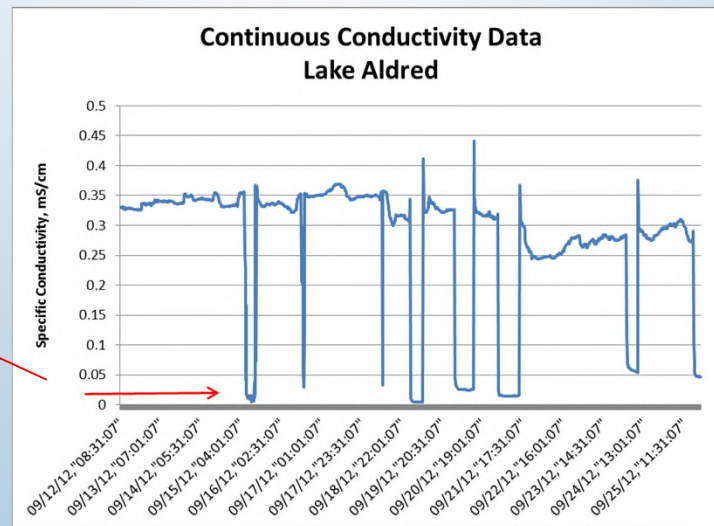


USGS 01578310 SUSQUEHANNA RIVER AT CONOWINGO, MD



Difficult Monitoring Conditions

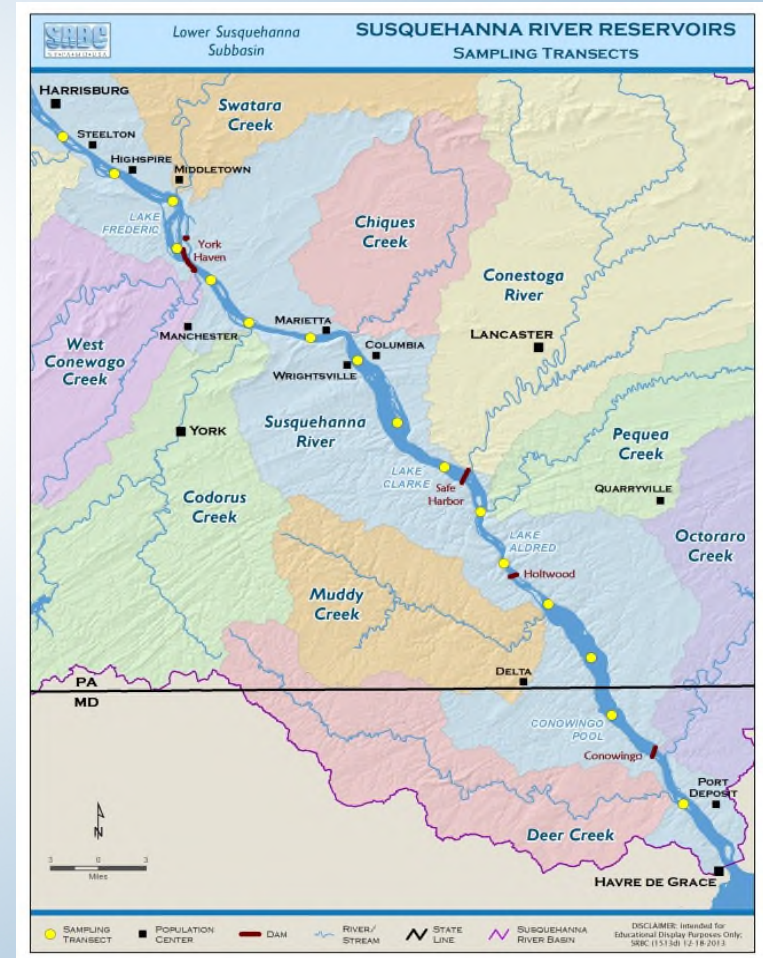
Hester-Dendy sampler
deployed in 3'+ of
water, recovered on
bank



De-watering events
captured on
continuous data
sonde via specific
conductivity

2014 Lower River Study

- Continuation and expansion of 2012 study
 - 16 sites from Harrisburg to mouth
 - free flowing vs. impounded
- Continuous instream monitoring
 - horizontal stratification of water chemistry
- Expanded fish monitoring



Questions??

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